

THE MIGRATION AND ESTABLISHMENT OF *JUNCUS GERARDII* (JUNCACEAE) IN THE INTERIOR OF NORTH AMERICA

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Juncus gerardii Loisel (Juncaceae), a member of the rush family occurs along the Atlantic and Pacific coasts of North America and locally inland on the continent. On the Atlantic coast, the plant is often a dominant member of the upper littoral zone where it may form extensive stands in salt marsh meadows at the upper limit of ordinary tides (Nichols, 1920). Apparently once confined to the coastal salt marshes, *J. gerardii* has evidently migrated inland where it has been reported from ten midwestern and Great Lakes states and the provinces of Manitoba and Ontario in the past 120 years. More recently it has invaded Colorado and Utah in western United States. This paper presents the documentation for the migration and establishment of *J. gerardii* as isolated occurrences in the interior of North America. The progressive range extension over a period of approximately 120 years and the present known North American distribution of *J. gerardii* based on herbarium data and published accounts are mapped in figure 1.

Although a true rush, *J. gerardii* is commonly called black grass. Other common names that have been applied to the species are given in Table 1. In earlier North American scientific literature, the species was reported under the name *J. bulbosus* L.

EAST COAST DISTRIBUTION AND EARLY OCCURRENCES IN THE INTERIOR

In eastern North America, the apparent native distribution of *J. gerardii* is in the Atlantic coastal salt marshes. Its range is usually stated as extending from Newfoundland, Quebec, Nova Scotia, New Brunswick, the coastal states of the United States to Virginia and sometimes to Florida. I have verified herbarium specimens of its coastal range from Newfoundland to Virginia. However, the southern limit of its Atlantic coastal range is not clear from the literature. In his classic revision of the North American species of *Juncus*, Engelmann (1866) reported the southern limit of *J. gerardii* as North Carolina and Florida and cited as authorities, Curtis and Ware, respectively. This range to Florida has been repeated by Fassett (1940), Fernald (1950), Muenscher (1944), Small (1933), Wiegand (1900), and mapped by Hultén (1958). However, its range is given as far south as Virginia in Gleason (1952), Gleason and Cronquist (1963),

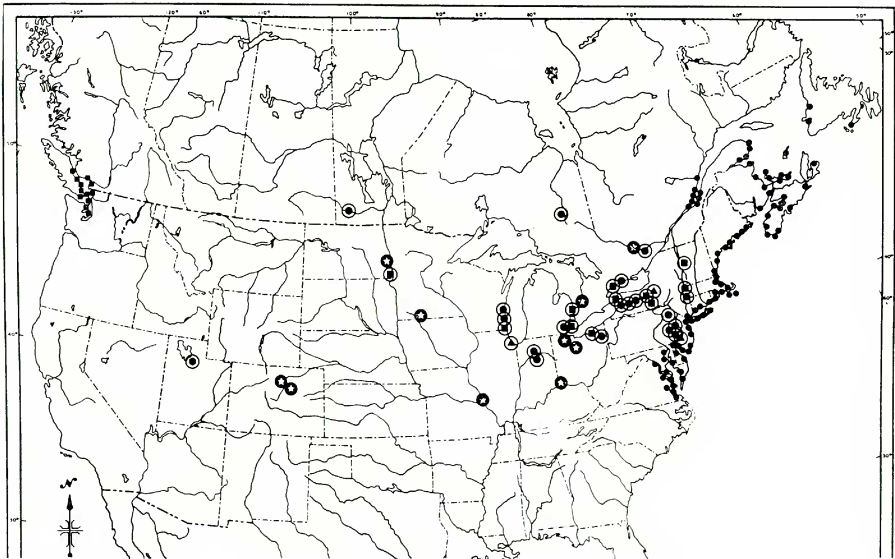
TABLE 1.
COMMON NAMES OF *Juncus gerardii* LOISEL OTHER THAN BLACK GRASS

COMMON NAME	REGION OF THE UNITED STATES WHERE USED	REFERENCES
Black-grass Rush	Florida	Ward (1968)
Gerard's Rush	New York; Ohio	Hanmer (1940); Schaffner (1914, 1932)
Hog-rush	Southeastern United States	Small (1933)
Nut grass	Maryland	McAttee (1933)
Salt-marsh Rush	New England	Scymour (1969a)
Saltmeadow Rush	British Columbia	Taylor and MacBryde (1977)

and only as far south as Delaware by Potter (1932). It is not reported for the Carolinas by Radford, Ahles, and Bell (1968) or from North Carolina by Beal (1977), but is listed for Florida by Ward (1968). According to Eleuterius (1976), *J. gerardii* is replaced by *J. roemerianus* beginning in New Jersey and extending southward in the east coastal salt marshes to Florida and on the Gulf Coastal Plain to Texas.

What is believed to be the earliest record of occurrence of *J. gerardii* inland in the United States appears in the *North American Botany* by Eaton and Wright (1840), where they reported the species for Michigan. No specimen has been located to verify this record. A second inland occurrence in the Great Lakes region was reported as "near Chicago . . . Dr. Vasey," by Engelmann (1866). This second record was apparently based on specimens obtained in 1862 in vacant lots at Chicago, Illinois, by George Vasey (GH, US). Vasey's specimens substantiate the statement in the 5th edition of Gray's *Manual* that *J. gerardii* was "rare along the Great Lakes" (Gray, 1867). The previous edition of the *Manual* noted that the species was "common along the coast from New Jersey northward" with no mention of locations in the interior on the continent (Gray, 1863). Gray's statement in the 5th edition of the *Manual* served as the basis for the record cited in three early catalogues of the flora of Michigan (Wheeler and Smith, 1881; Beal and Wheeler, 1892; Beal, 1905), rather than the citation of the record in Eaton and Wright (1840).

The beginning of the inland spread of *J. gerardii* is documented in New Jersey and Pennsylvania where the species was first reported as "Not frequent" from a specimen obtained in 1866 on ballast ground at Petty's Island



near Philadelphia in the Delaware River (Smith, 1867). Herbarium specimens (MO, PENN, PH, US) from ballast habitats in Camden and Philadelphia date from 1863 to 1876 and document this early introduction. The species has spread northward into Leigh, Montgomery, and Northampton Counties, Pennsylvania, where it is known from alluvial flats and wet meadows along railroads, as documented by specimens dating from 1924 into the 1960's (PENN, PH). Schaeffer (1949) reported that the populations in Northampton County "probably represent plants which were introduced by salt hay."

ESTABLISHMENT IN THE MIDWESTERN AND GREAT LAKES STATES

Expansion of the range of *J. gerardii* in New York evidently came in the mid-to late-nineteenth century. Torrey (1824) gave its distribution in that state as "common in the vicinity of New-York," and later Torrey (1843) wrote "Borders of creeks and ditches in salt marshes: common on Long Island and Staten Island." Gray (1863) in the 4th edition of his *Manual* noted its distribution as "Salt marshes; common along the coast from New Jersey northward." However, in the 5th edition, Gray (1867) first noted it as "also in saline marshes of W. New York." This apparent range extension was probably based on the specimens obtained in 1864 and 1865 at Salina, Onondago County, by George W. Clinton (MO, PH) which also was the basis for the citation in Engelmann's revision (1866). In a catalogue of plants of that vicinity, Paine (1865) noted *J. gerardii* from "Rivuletsides and wet banks, east of Salina and west of Onondaga Lake, in thick patches. Common there." Twenty years later, the species was listed as "sparingly, on the brackish marshes E. of Montezuma" in the Cayuga Lake Basin in western New York (Dudley, 1886). In central New York, additional locations are known from Fall Creek, Myers Point, the Union Springs (Wiegand and Eames, 1926), at Silver Springs near Gainesville in Wyoming County, and at Greigsville near York in Livingston County (Zenkert, 1934). At the Silver Springs locality, *J. gerardii* was noted on 30 August 1926 as common in a number of places along Wolf Creek where salt and brine from the Remington Salt Factory was being dumped into the stream (Muenscher, 1927a, b). Additional localities in central and

Figure 1. Distribution of *Juncus gerardii* in North America, with emphasis on its spread into the interior of the continent. Large symbols show locations of cited specimen records and periods of time they were obtained, according to the following key: Triangles in circles (1860-1884), squares in circles (1885-1919), dots in circles (1920-1949), stars in circles (1950-1979). Small symbols indicate the general range of the species along the coast. Dots show the apparent native range along the east coast; squares show the range on the west coast. In addition to herbarium records, the east coast range is derived from maps by Erskine (1960), Hultén (1958), Potter (1932), Roland (1945), and Rousseau (1974).

western New York include Hamburg, Ithaca, Lansing, McLean, Piffard, Retsof, Springport, and Syracuse, as derived from the list of cited specimens. The species has apparently spread in the man-created saline habitats of central and western New York, although some writers have doubted its being non-indigenous to the area (Wiegand and Eames, 1926). A century later, *J. gerardii* continues to persist in Onondago County, the same county where it was initially discovered in the interior of the state of New York (Faust, 1961). In the eastern part of the state, the species has been located on rocks in the bed of Kinderhook Creek at Stuyvesant Falls in Columbia County (McVaugh, 1958) and in moist depressions on dredgings from the Hudson River at Rensselaer (BH, CU) indicating that it had moved inland along the Hudson River in the 1930's.

In Ohio, *J. gerardii* has always been considered native, including the most recent treatment by Braun (1967), although she allowed that the species was "perhaps introduced along railroad tracks." First recorded by Beardslee (1874) as "rare" from "Lake [Erie] Shore," this record was repeated by Kellerman and Werner (1893). The earliest known specimens are those obtained in 1891 and 1895 at Cleveland by Edo Claassen (OS), which served as the basis for the record in his Cuyahoga County list of plants (Claassen, 1895). These Cuyahoga County specimens also served as the basis for Schaffner's only record in his two catalogs of Ohio vascular plants (Schaffner, 1914, 1932). A second record was taken 34 years later at Phalanx in Trumbull County by Almon N. Rood (OS). The plants were "abundant in low, wet swale," but were erroneously reported as *J. greenii* (Schaffner, 1933), and later corrected (Schaffner, 1935). Additional specimens obtained by Rood in 1936 were labeled as "Phalanx Station, wet swale by R.R.," supporting the hypothesis that the species had probably invaded via the railway. More recent records have come from along a railroad at Crestline in Crawford County by Floyd Bartley (OS) and from a ditch at the International Salt Company at the mouth of the Cuyahoga River in Cuyahoga County by Allison Cusick (KE).

The only known specimens of *J. gerardii* for Michigan are those obtained by C. K. Dodge in 1911 and 1915 at Port Huron in St. Clair County and by O. A. Farwell in 1931 and 1932 at Wayne in Wayne County (Voss, 1972). The 1911 specimens came from railroad yards. The 1931 plants were from wet ditches, and as reported by Farwell (1941) were then believed to be the first record for Michigan. Voss (1972) has stated that this species is "quite probably not indigenous in Michigan."

In Indiana, Peattie (1930) first reported *J. gerardii* as very rare from brackish wet sand in Indiana Harbor, Lake County, but attempts to locate a specimen from this locality have been unsuccessful. In 1935, however, the species was first found to be well established on dry open ground along the Nickle Plate Railroad four miles east of Kokomo, Howard County by C. M. Ek (Hermann, 1938, 1940). In 1942, the species was obtained farther

north in the next county, Miami County, along the Pennsylvania Railroad, three miles west of Bunker Hill by C. M. Ek (GH, MO).

Vasey's record of *J. gerardii* from near Chicago has long been disputed. Jones and Fuller (1955) excluded it from the flora of Illinois, because the species was "not attributed to Illinois, or indeed even mentioned, in any of Vasey's published reports on the flora of Illinois, . . ." Their conclusion was accepted until more recent studies have verified its occurrence in the Chicago area, based on specimens collected in 1900 and 1956 (DeFilipps, 1964, 1966; Mohlenbrock, 1970; Swink, 1969, 1974).

KNOWN RECORDS FROM OTHER STATES

VERMONT: First reported "on the margin of a marshy meadow very near the railway station at New Haven Junction: where it was believed to have been imported in "saltmarsh hay often used in packing" (Eggleston, 1904). Not reported earlier in the flora of Vermont (Brainerd, Jones and Eggleston, 1900), nor in the most recent flora of Vermont (Seymour, 1969b).

WISCONSIN: Reported from near railroad yards in Milwaukee and Sheboygan Counties (McIntosh, 1950), based on specimens obtained in the 1930's, and in Racine County as early as 1900 (Swink, 1969, 1974). The most recent specimen, taken in 1977, is from a wet area along railroad tracks in Fox Point, Milwaukee County (OSH).

MINNESOTA: Stated by Hultén (1958) as a weed along railways in Minnesota, with a mapped location in the southern part of the state evidently based on the record from Martin County obtained in 1950. The species is also cited for Clay and Kittson Counties (McGregor and Barkley, 1977) based on records from the 1960's. The specimen from Clay County is *J. alpinus* (shoulder of roadside ditch, Muskoda, 8 Jul 1960, O. A. Stevens 2231, DAO, US), and the specimen from Kittson County is *J. compressus* (roadside at Caribou, 28 Jun 1962, J. W. Moore 26083, TRT).

NORTH DAKOTA: Listed for Cass and Richland Counties (Stevens, 1961; McGregor and Barkley, 1977). The record from the latter county is dated 1908.

MISSOURI: Observed during the years 1964 through 1966 in the southern part of the Ranken yard of the Terminal Railroad Association, east of Compton Avenue, in St. Louis (Muehlenbach, 1969).

KENTUCKY: Obtained in 1978. This specimen is the most recently known record and is from a population of plants in diesel sludge mud of railroad yard near tracks, near junction of West 19th Street and Augusta Street, Covington, Kenton County (OS).

Selected Specimens: ILLINOIS: [Cook Co.]: Vacant lots, Chicago, 1862, *Vasey s.n.* (GH, US); railroad and roadside, Chicago, 1956, *Glassman 3788* (CHI, ILLS, NP). INDIANA: Howard Co.: Railroad, Kokomo, 1935, *Ek s.n.* (GH, IND), 1936, *Deam 57045* (NY). Miami Co.: Railroad, Bunker Hill, 1942, *Ek s.n.* (GH, MO). KENTUCKY: Kenton Co.: Railroad yard, Covington, 1978, *Applegarth 465* (OS). MICH-

GAN: [St. Clair Co.]: Railroad freight yards, Tunnel Station, 1911, *Dodge s.n.*, (MICH); damp ground, Port Huron, 1915, *Dodge s.n.* (US). [Wayne Co.]: Ditches, Wayne 1931, *Farwell s.n.* (GH), *Farwell 8897* (MICH). MINNESOTA: Martin Co.: Railroad, Fairmont, 1950, *Moore 20689* (GH, MIN). MISSOURI: St. Louis Co.: Railroad, St. Louis, 1964, *Muehlenbach 2356* (MO, US); 1965, *Muehlenbach 2505, 2522, 2476* (MO); 1966, *Muehlenbach 2625* (MO). NEW JERSEY: [Camden Co.]: Camden, 1863, *Canby s.n.* (MO): ballast, Petty's Island in Delaware River, 1866, *Burk s.n.* (MO), *Diffenbach s.n.* (MO, PH), *Parker s.n.* (GH, MO, PH); ballast, Kaighns Point, 1876, *Martindale s.n.* (PH, US). NEW YORK: Cayuga Co.: Brackish meadow east of Salt Creek, Montezuma, 1885, *Dudley s.n.* (CU); brackish place by railroad station, Union Springs, Springport, 1919, *Eames & Wiegand 11730* (CU, GH); salty meadows, Montezuma, 1919, *Wiegand, Randolph, & Eames 11729* (CU). Columbia Co.: Bank of creek, Stuyvesant Falls, 1933, *McVaugh 997* (NY, PENN); rocks in Kinder Creek, Stuyvesant Falls, 1945, *McVaugh 3126* (CU). Erie Co.: Meadow, Hamburg, 1939, *Glouvenke 3868* (PENN). Livingston Co.: Ditches along roadside, salt factory, Piffard, 1926, *Muenschner 16495* (CU, GH); stream bank, salt factory, Retsof, 1926, *Muenschner 16495* (CU). [Onondaga Co.]: Salina, 1864, *Clinton s.n.* (MO), 1865 (PH); salt marshes, Syracuse, 1880, *Sheldon 2973* (US); salt marshes, Onondaga Lake, 1883, *Habertr 954* (CAN, US), *s.n.* (MO). Rensselaer Co.: Moist depressions in dredgings Hudson River, Rensselaer, 1939, *House 27070* (BH, CU). Tompkins Co.: Railroad, Myers, Lansing, 1918, *Eames 9559* (CU, GH); railroad ditch, McLean, 1920, *Wiegand & Muenschner 13448* (CU, GH). Wyoming Co.: Salt marsh, Silver Springs, 1926, *Muenschner & Burkholder 16498* (CU, GH). NORTH DAKOTA: Cass Co.: Railroad, Fargo, 1954, *Stevens 1497* (DAO, NY, US). Richland Co.: Sandy soil, Colfax, 1908, *Ball 694* (US). OHIO: Crawford Co.: Railroad, Crestline, 1960, *Bartley s.n.* (NY, OS). Cuyahoga Co.: Cleveland, 1891, 1895, *Claassen s.n.* (OS); ditch, International Salt Company, mouth of Cuyahoga River, Cleveland, 1974, *Cusick 13723* (KS). Trumbull Co.: Wet swale, Phalanx Station, 1925, *Rood s.n.* (OS); wet swale, railroad, Phalanx Station, 1936, *Rood 1077* (KS, NY, PENN). PENNSYLVANIA: Lackawanna Co.: Roadside ditch, Carbondale, 1946, *Glouvenke 6812* (GH, PENN). Leigh Co.: Railroad, Laury's Station, 1924, *Pretz 12155* (PH); meadow, Allentown, 1960, *Schaeffer 6095* (PH). Montgomery Co.: Railroad, Harbors, 1943, *Long 59871* (PH). Northampton Co.: Meadow, Butztown, 1946, *Schaeffer 22738* (PH); railroad, Northampton, 1947, *Schaeffer 25947* (PH); shore, Siegrid, 1961, *Schaeffer 63226* (PH). [Philadelphia Co.]: Ballast ground below the navy yard, Philadelphia, 1866, *Parker s.n.* (MO, PH). VERMONT: [Addison Co.]: Railroad, New Haven Junction, 1897, *Brainerd s.n.* (GH). WISCONSIN: [Racine Co.]: Lake beach, Racine harbor, 1900, *Wadmond 2740* (CU, MIN, WIS). Milwaukee Co.: Railroad Estabrook Park, Shorewood, 1939, *Sbinners 1069* (PENN, WIS); railroad, Fox Point, 1977, *Harriman 14125* (OSH). Sheboygan Co.: Railroad yard, Sheboygan, 1933, *Goesl s.n.* (WIS).

DISTRIBUTION IN THE INTERIOR OF CANADA

In Canada, *J. gerardii* was early reported by Macoun (1888) from only coastal marshes in Nova Scotia, New Brunswick, Quebec, and Vancouver Island. In the interior of Canada, in Ontario, *J. gerardii* was not included among the introduced plants of that province (Montgomery, 1956). However, the species has been known from the province as early as 1903, based on specimens obtained by William Scott (CAN, CU, DAO, TRT) from a railroad roundhouse at Niagra Falls. *J. gerardii* has been located in Ontario at other isolated sites along railways, usually at stations where salt has been

sprinkled to melt snow in the winter. The most recent records seen are from 1974, 1975, and 1976, (CAN, DAO, TRT). In the Toronto region, Catling and McKay (1975) have described the plant communities at two saline sites, one a salt storage depot on the west side of the Don River near the Bloor Street viaduct and the other a snow dumping site on landfill at the foot of Leslie Street, where *J. gerardii* is plentiful with other halophytes. Boivin (1952) reported the species as a weed along railway embankments at Cochrane and Hope in Ontario and at Brandon in Manitoba.

Selected Specimens: MANITOBA: Weed along railway embankments, Brandon (cited by Boivin, 1952). ONTARIO: Carleton Co.: Slightly saline soil, at Mississippi River bridge east of Arnprior, 27 miles west of Ottawa, 1959, *Dore & Cody 17425* (MSC); river, Rockcliff Park, Ottawa, 1947, *Calder, Dore, & Cody 1641* (MO). [Cochrane Co.]: Railway yards, Cochrane, 1952. *Baldwin 3912* (CAN, GH). Durham Co.: Abandoned railway, Hope Township, 1948, *Reeve 87* (DAO). Essex Co.: 1913, *Malte s.n.* (CAN); dry open saline ground, Windsor Salt Factory, Windsor, 1975, *Catling & McKay s.n.* (CAN, TRT). Huron Co.: Saline soil, south side of Maitland River, below Sifto Salt brine operation, Goderich, 1975, *Catling & McKay s.n.* (CAN, TRT). Welland Co.: Railroad roundhouse, Niagra Falls, 1903, *Scott s.n.* (CAN, CU, DAO, TRT); Montrose railway yard, Niagra Falls, 1976, *Catling & McIntosh s.n.* (DAO, TRT); ditch between two rail embankments, Bertie Township, Niagra, 1976, *Catling & Riley s.n.* (DAO, TRT). York Co.: Dump heap, Ashbridge's Bay, Toronto, 1904, *Scott s.n.* (CU, TRT); wet depression receiving run off from rock salt storage depot, opposite Don Valley Brickyard, Don Valley, Toronto, 1974, *Catling & McKay s.n.* (CAN, TRT); in snow dumping area, foot of Leslie Street, Toronto, 1974, *Catling & McKay s.n.* (TRT).

DISTRIBUTION IN WESTERN NORTH AMERICA

On the west coast, *J. gerardii* is known from the coastal salt marshes in the Puget Sound area in the state of Washington, on Vancouver Island, and in southern British Columbia. Some question has been raised as to whether or not the species is native there because the morphology of the plants more closely resemble those from Europe, whence they may have been introduced at an early date (Hitchcock, Cronquist, and Ownbey, 1969). The species was first reported from salt marshes at Victoria, Vancouver Island by Macoun (1838), based on his collection of 26 Jun 1887 (GH). However, the species was not included in the *Flora of Washington* by Piper (1906). The earliest known specimen from Washington is dated 1917 and comes from Lopez on San Juan Island where it was obtained by S. M. and Mrs. E. B. Zeller (GH). Additional records were added in the 1920's and 1930's. Muenscher (1941) wrote the *J. gerardii* was local in salt marshes and cited two localities, South Bellingham and Marietta in Whatcom County. St. John (1928) considered the plants on the west coast as a native species and proposed the name *J. fucensis*.

Inland in the Rocky Mountains of western United States, *J. gerardii* has been located in two states:

COLORADO: Known from wetlands at one site in Adams County and two locations in Boulder County, as reported by Hermann (1975). The earliest record is from the latter county, dated 1952.

UTAH: Reported as "Introduced and established in salt marshes near Salt Lake City" (Tidestrom, 1925). This record is apparently based on a specimen from a salt grass pasture near Salt Lake City (Jun 1922, *G. Q. Bateman s.n.*, US). The species was not included in the *Intermountain Flora* by Cronquist (1977).

SOME GENERAL CONSIDERATIONS AND CORRECTIONS

It has become apparent that the spread of *J. gerardii* inland into the Great Lakes region and midwestern United States has come about by either migration of the species via railroads or by establishment in inland saline marshes, as documented in the above specimen citations and summarized in Table 2. Of the 58 known inland stations east of the Great Plains, 26 of them (44%) are from along railroads and 13 of them (22%) are from inland saline habitats in New York, Ohio, and Ontario. Most, if not all, of the inland saline habitats cited here have been artificially created since the coming of European man. Other significant localities are man-made roadside ditches and ballast ground, which account for the habitat at eight localities (14%). The occurrence in isolated sites and especially in man-created habitats which account for 80% of the known localities, strongly suggests that *J. gerardii* is a non-indigenous member of the wetland flora of the Great Lakes region, mid-western, and certain western areas in the United States. Furthermore, the occurrence of *J. gerardii* in the Finger Lakes region of New York, for example, conforms to Svenson's idea that human agencies have been perhaps the most effective means of distributing these halophytic species into that region, rather than surviving as remnants from a post-Pleistocene marine submergence (Svenson, 1927).

As pointed out by Eggleston (1904) in Vermont and by Schaeffer (1949) in Pennsylvania, *J. gerardii* has been transported as a salt hay in packing. In Massachusetts, Deane (1915) noted that black grass was cut in the summer and fall and used for packing on celery beds to keep the stocks from freezing during the winter. The plants also can form "balls" or "pebbles" from matted sods which are thrown upon beaches during ditching operations (Ganong, 1905). These sods are rolled about, worn down, and rounded by action of the waves and may even be transported.

Potter (1932, 1934) cited *J. gerardii* as an example of a halophytic species whose distribution supported the idea of a post-Pleistocene marine connection between Hudson Bay and the St. Lawrence River basin. Those species which he used as evidence occurred in the southern region of Hudson Bay at James Bay, were disjunct to the Gulf of St. Lawrence, and then ranged southward along the Atlantic coast. *J. gerardii*, however, showed certain irregularities by having isolated occurrences in the Finger Lakes region of

TABLE 2.

SUMMARY OF INLAND HABITAT TYPES OF *J. gerardii* IN RELATION TO THE NUMBER OF LOCALITIES IN THE MIDWESTERN AND GREAT LAKES STATES AND IN MANITOBA AND ONTARIO.

HABITAT	NUMBER OF LOCALITIES	PERCENTAGE OF TOTAL NUMBER OF LOCALITIES
Railroad	26	44
Salt marsh; saline or brackish marsh	13	22
Roadside ditch	4	7
Ballast ground and dredgings	4	7
Other habitats	11	20
Total	58	100%

New York, at the southern end of Lake Michigan, and on the Pacific coast. This irregularity has now been explained. Earlier, Peattie (1922) had correctly omitted *J. gerardii* as an example of a natural member of the Atlantic Coastal Plain element in the Great Lakes region. Moreover, as reported and mapped by Rousseau (1974), *J. gerardii* is not known at James Bay, and he has stated that Potter's specimen at the Gray Herbarium is *J. alpinus*, as determined by L. Cinq-Mars. The report from a James Bay by Macoun (1888), which Rousseau could not verify, apparently is from a local James Bay at Vancouver Island, British Columbia. Macoun's published report is clear, "Salt marsh at the head of James Bay, Victoria, Vancouver Island, 1887. (*Macoun.*)," and agrees with the date on the label of his specimen (24 June 1887, *Macoun* 27,869, CAN).

ACKNOWLEDGEMENTS

My thanks are extended to Mr. Mark Davis who assisted with this research during the summer of 1977. My thanks are also extended to the curators of the herbaria who made specimens and records available. Those herbaria in which I have examined specimens are: BH, CAN, CU, DAO, KS, MICH, MO, MSC, NYS, OS, OSH, PENN, PH, US. Those herbaria from which only records were seen are: GH, MIN, NY, TRT, WIS.

REFERENCES

- BEAL, E. O. 1977. A manual of marsh and aquatic vascular plants of North Carolina with habitat data. North Carolina Agric. Exp. Sta., Raleigh. Tech. Bull. No. 247. 298 pp.
- BEAL, W. J. 1905. Michigan Flora. Rep. Michigan Acad. (1904) 5: 1-147.
- _____ and C. F. WHEELER. 1892. Michigan Flora. Ann. Rep. State Board Agric. Michigan (1891) 30: 471-650. (Reprinted and repaged 1-180.)

- BEARDSLEE, H. C. 1874. Catalogue of the plants of Ohio, including flowering plants, ferns, mosses and liverworts. Painesville, Ohio. 19 pp. (Reprinted Ann. Rep. Ohio State Board Agric. (1877) 32: 335-363. 1878.)
- BOIVIN, B. 1952. The distribution of *Arnica wilsonii* Rydberg and its significance. *Rhodora* 54: 200-215.
- BRAINERD, E., L. R. JONES, and W. W. EGGLESTON. 1900. Flora of Vermont. A list of the fern and seed plants growing without cultivation. Vermont Bot. Club, Contrib. Bot. Vermont, VIII. Burlington. 113 pp.
- BRAUN, E. L. 1967. The Monocotyledoneae [of Ohio]. Cat-tails to Orchids. With the Gramineae by Clara G. Weishaupt. The Ohio State Univ. Press, Columbus. 464 pp.
- CATLING, P. M. and S. M. MCKAY. 1975. Association of halophytic plants in the Toronto region. *Ontario Field Biol.* 29(1): 50-55.
- CLAASSEN, E. 1895. List of monocotyledonous and vascular-cryptogamous plants of Cuyahoga County, Ohio. 3rd Ann. Rep. Ohio State Acad. Sci. 26-27.
- CRONQUIST, A. 1977. Juncaceae, pp 47-67. In Arthur Cronquist, Arthur H. Holmgren, James L. Reveal, and Patricia K. Holmgren. Intermountain Flora: Vascular plants of the Intermountain West, U. S. A. Vol. Six The Monocotyledons. Columbia Univ. Press, New York. 584 pp.
- DEANE, W. 1915. Floral changes in a salt marsh during reclamation. *Rhodora* 17: 203-222.
- DE FILIPPS, R. A. 1964. A taxonomic study of *Juncus* in Illinois. *Amer. Midl. Naturalist* 71: 296-319.
- _____. 1966. Distribution of *Juncus* in Illinois. *Phytologia* 13: 44-64.
- DUDLEY, W. R. 1886. The Cayuga Flora. Part I: A catalogue of the phanogamia growing without cultivation in the Cayuga Lake Basin. *Bull. Cornell Univ.* 2: 1-XXX, 1-32 + Additions and Corrections, Index to Orders and Genera, i-v.
- EATON, A. and J. WRIGHT. 1840. North American botany, comprising the native and common cultivated plants, north of Mexico: Genera arranged according to the artificial and natural methods. 8th ed. Elian Gates, Troy, New York, 625 pp.
- EGGLESTON, W. W. 1904. Addenda to the flora of Vermont. *Rhodora* 6: 137-144.
- ELEUTERIUS, L. N. 1976. The distribution of *Juncus roemerianus* in the salt marshes of North America. *Chesapeake Sci.* 17: 289-292.
- ENGELMANN, G. 1866. A revision of the North American species of the genus *Juncus*, with a description of new or imperfectly known species. *Trans. St. Louis Acad. Sci.* 2: 424-498.
- ERSKINE, D. S. 1960. The plants of Prince Edward Island. *Plant Res. Inst. Res. Branch. Canad. Depr. Agric. Publ.* 1988. 270 pp.
- FARWELL, O. A. 1941. Notes on the Michigan flora. VIII. Pap. Michigan Acad. Sci. (1940) 26: 3-20.
- FASSETT, N. C. 1940. A manual of aquatic plants. McGraw Hill Book Co., New York. 382 pp. (Reprinted with revision appendix by Eugene C. Ogden. Univ. Wisconsin Press, Madison. 405 pp. 1957, 1960, 1966, 1969, 1972, 1975.)
- FAUST, M. E. 1961. Checklist of the vascular plants of Onondaga County, New York. *Bull. Syracuse Mus. Nat. Sci.* No. 9. 83 pp.
- FERNALD, M. L. 1950. Gray's manual of botany. 8th ed. American Book Co., Inc. Ixiv + 1632 pp. (Reprinted by D. Van Nostrand Co., New York. 1970).
- GANONG, W. F. 1905. On balls of vegetable matter from sandy shores. *Rhodora* 7: 41-47.
- GLEASON, H. A. 1952. The new Britton and Brown illustrated flora of the north-eastern United States and adjacent Canada. Vol. I. New York Bot. Gard., New York. 482 pp.
- _____. and A. CRONQUIST. 1963. Manual of vascular plants of northeastern United States and adjacent Canada. D. Van Nostrand Co., Inc., New York. 810 pp.

- GRAY, A. 1863. Manual of botany of the northern United States, including Virginia, Kentucky, and all east of the Mississippi. 4th ed. Ivison, Phinney, & Co., New York. 743 pp. + XXII pls.
- . 1867. Manual of the botany of the northern United States, including the district east of the Mississippi and north of North Carolina and Tennessee, arranged according to the natural system. 5th ed. Ivison, Blakeman, Taylor & Co., New York. 703 pp. + XX pl.
- HAMMER, C. C. 1940. Plants of Fishers Island. *Torreyia* 40: 65–81.
- HERMANN, F. J. 1938. New or otherwise interesting plants from Indiana. *Rhodora* 40: 77–83.
- . 1940. *Juncus*, pp. 290–302. In Charles C. Deam. Flora of Indiana. Dept. Conservation, Div. Forestry, Indianapolis. 1236 pp. (Reprinted in the series, Reprints of US-Floras, Vol. 6. Verlag von J. Cramer, Lehre. 1970).
- . 1975. Manual of the rushes (*Juncus* spp.) of the Rocky Mountains and Colorado Basin. U. S. D. A. Forest Service Gen. Tech. Rep. RM-18. 107 pp.
- HITCHCOCK, C. L., A. CRONQUIST and M. OWNBEY. 1969. Vascular plants of the Pacific Northwest Part 1: vascular cryptogams, gymnosperms, and monocotyledons. Univ. Washington Press, Seattle. 914 pp.
- HULTÉN, E. 1958. The Amphi-Atlantic plants and their phytogeographical connections. Kungl. Svenska Vetenskapsakademiens Handlingar Fjärde Serien. Band 7. Nr. 1. 340 pp. (Reprinted Otto Koeltz Koenigstein-Taunus/B. R. D. 1973.)
- JONES, G. N. and G. D. FULLER. 1955. Vascular plants of Illinois. Univ. Illinois Press, Urbana. 593 pp.
- KELLERMAN, W. A. and W. C. WERNER. "1893" [1894]. Catalogue of Ohio plants. Rep. Geol. Surv. Ohio 7: 56–406.
- MACOUN, John. 1888. Catalogue of Canadian plants. Part IV.—Endogens. Geol. & Nat. Hist. Soc. Canada. 2(4): 1–248.
- McATEE, W. L. 1933. Some local names of plants V. *Torreyia* 33: 81–86.
- McGREGOR, R. L. and T. M. BARKLEY, eds. 1977. Atlas of the flora of the Great Plains. Iowa State Univ. Press, Ames. 600 pp.
- McINTOSH, J. A. 1950. Preliminary reports on the flora of Wisconsin. XXXIV. Liliales. *Trans. Wisconsin Acad. Sci.* 40: 215–242.
- McVAUGH, R. 1958. Flora of the Columbia County area, New York. New York State Mus. & Sci. Serv. Bull. No. 360. 400 pp.
- MOHLENBROCK, R. H. 1970. The illustrated flora of Illinois: flowering plants, flowering rush to rushes. Southern Illinois Univ. Press, Carbondale and Edwardsville. 272 pp.
- MONTGOMERY, F. H. 1956. The introduced plants of Ontario growing outside of cultivation (Part I). *Trans. Roy. Canad. Inst.* 31: 91–102.
- MEUHLENBACH, V. 1969. Adventive plants new to the Missouri flora (III). *Ann. Missouri Bot. Gard.* 56: 163–171.
- MUENCHER, W. C. 1927a. Appendix VIII. Salt plants of Wolf Creek, p. 87. In A biological survey of the Genesee River system state of New York Conservation Department Supplemental to Sixteenth Annual Report, 1926. Albany. 100 pp. + 5 maps.
- . 1927b. *Spartina patens* and other saline plants in the Genesee valley of western New York. *Rhodora* 29: 138–139.
- . 1941. The flora of Whatcom County state of Washington. Published by the author, Ithaca. 134 pp. + Index.
- . 1944. Aquatic Plants of the United States. Comstock Publishing Co., Ithaca, New York. 374 pp. (Reprinted 1948, 1964, 1967).
- NICHOLS, G. E. 1920. The vegetation of Connecticut. VII. The associations of depositing areas along the seacoast. *Bull. Torrey Bot. Club* 47: 511–548.

- PAINE, J. A., Jr. 1865. Catalogue of plants found in Oncida County and vicinity. Rep. Regents Univ. New-York. 140 pp.
- PEATTIE, D. C. 1930. Flora of the Indiana dunes: A handbook of the flowering plants and ferns of the Lake Michigan coast of Indiana and of the Calumet District. Field Mus. Nat. Hist., Chicago. 432 pp.
- . 1922. The Atlantic coastal plain element in the flora of the Great Lakes. *Rhodora* 24: 57-70, 80-88.
- PIPER, C. V. 1906. Flora of the state of Washington. *Contrib. U. S. Natl. Herb.* 11: 1-637.
- POTTER, D. 1932. Botanical evidence of post-Pleistocene marine connection between Hudson Bay and the St. Lawrence basin. *Rhodora* 34: 69-89, 101-112. (Reprinted *Contrib. Gray Herb. Harvard Univ.* 99.)
- . 1934. Plants collected in the southern portion of James Bay. *Rhodora* 36: 274-284.
- RADFORD, A. E., H. E. AHLES and C. R. BELL. 1968. Manual of the vascular flora of the Carolinas. Univ. North Carolina Press, Chapel Hill. 1183 pp.
- ROLAND, A. E. "1945" [1947]. The flora of Nova Scotia. *Proc. & Trans. Nova Scotian Inst. Sci.* 21: 95-642. (Reprinted Truro Printing & Publishing Co., Truro. 127 figs. 1948.)
- ROUSSEAU, C. 1974. Geographic floristique du Quebec-Labrador: distribution des principales especes vasculaires. Les Presses de l'Université Laval, Quebec. 798 pp.
- SCHAEFFER, R. L., Jr. 1949. The vascular flora of Northampton County, Pennsylvania. A dissertation in botany presented to the faculty of the graduate school in partial fulfillment of the requirements for the degree of doctor of philosophy, Univ. Pennsylvania, Philadelphia. 702 pp.
- SCHAFFNER, J. H. 1914. Catalog of Ohio vascular plants. *Ohio Biol. Surv.* 1: 125-247. *Bull.* 2.
- . 1932. Revised catalog of Ohio vascular plants. *Ohio Biol. Surv.* 5: 87-215. *Bull.* 25.
- . 1933. Additions to the revised catalog of Ohio vascular plants. I. *Ohio J. Sci.* 33: 288-294.
- . 1935. Additions to the revised catalog of Ohio vascular plants. III. *Ohio J. Sci.* 35: 297-303.
- SEYMOUR, F. C. 1969a. The Flora of New England. A manual for the identification of all vascular plants, including fern and fern allies and flowering plants growing without cultivation in New England. Charles E. Tuttle Co., Rutland, Vermont. xvi + 596 pp.
- . 1969b. The Flora of Vermont: A manual for the identification of ferns and flowering plants growing without cultivation in Vermont. 4th ed. *Agric. Exp. Sta. Bull.* 660. Univ. Vermont, Burlington. 393 pp.
- SMALL, J. K. 1933. Manual of the southeastern flora. Univ. North Carolina Press, Chapel Hill. xxii + 1554 pp.
- SMITH, A. H. 1867. On colonies of plants observed near Philadelphia. *Proc. Acad. Nat. Sci. Philadelphia* 19: 15-24 (Reprinted in R. L. Stucky, ed. *Essays on North American plant geography from the nineteenth century.* Arno Press Inc., New York. 1978).
- ST. JOHN, H. 1928. New plants from British Columbia. *Rep. Prov. Mus. Nat. Hist. British Columbia* 1927; E14 (Reprinted *Contrib. Washington State Coll. Bot. Dept.* 10: 1. 1928.)
- STEVENS, O. A. 1961. New records for North Dakota. *Rhodora* 63: 39-46.
- SVENSON, H. K. 1927. Effects of post-pleistocene marine submergence in eastern North America. *Rhodora* 29: 41-48, 57-72, 87-93, 105-114.
- SWINK, F. 1969. Plants of the Chicago region. The Morton Arboretum, Lisle, Illinois. 445 pp.

- _____. 1974. Plants of the Chicago region. 2nd ed. The Morton Arboretum, Lisle, Illinois. 474 pp.
- TAYLOR, R. L. and B. MacBRYDE. 1977. Vascular plants of British Columbia: A descriptive resource inventory. Bot. Gard. Univ. British Columbia Tech. Bull. No. 4. xxiv + 754 pp.
- TIDESTROM, I. 1925. Flora of Utah and Nevada. Contrib. U. S. Natl. Herb. 25: 1-665 + pls. 1-15. (Reprinted in the series, Reprints of US-Floras, Vol. 3. Verlag von J. Cramer, Lehre. 1969.)
- TORREY, J. 1824. Flora of the northern and middle sections of the United States; or, A systematic arrangement and description of all the plants hitherto discovered in the United States north of Virginia. T. and S. Swords, New York. 518 pp.
- _____. 1843. A Flora of the state of New-York, comprising full descriptions of all the indigenous and naturalized plants hitherto discovered in the state; with remarks on their economical and medical properties. Vol. II D. Appleton & Co., New York. 572 pp. + pls.
- VOSS, E. G. 1972. Michigan Flora: A guide to the identification and occurrence of the native and naturalized seed-plants of the state Part I gymnosperms and monocots. Cranbrook Inst. Sci., Bloomfield Hills, Bull. 55, and Univ. Michigan Herb., Ann Arbor. xviii + 488 pp.
- WARD, D. B. 1968. Checklist of the vascular flora of Florida Part I. Agric. Exp. Sta., Univ. Florida, Gainesville. Tech. Bull. 726. 72 pp.
- WHEELER, C. F. and E. F. SMITH. 1881. Michigan Flora. Ann. Rep. State Hort. Soc. Michigan (1880) 10: 427-529. (Reprinted with title page and repaged 1-105, as catalogue of the phaenogamous and vascular cryptogamous plants of Michigan, indigenous, naturalized and adventive.)
- WIEGAND, K. M. 1900. *Juncus tenuis* Willd. and some of its North American allies. Bull. Torrey Bot. Club 27: 511-527.
- _____. and A. J. EAMES. 1926. The flora of the Cayuga Lake Basin, New York. Cornell Univ. Agric. Exp. Sta. Mem. 92. 491 pp.
- ZENKERT, C. A. 1934. The flora of the Niagara frontier region. Ferns and flowering plants of Buffalo, N.Y., and vicinity. Buffalo Soc. Nat. Sci. Bull. 16: 1-x, 1-328.